CLAIMS:

1. Access apparatus for connecting to a data network (28) a plurality of digital subscriber lines (DSL_1,...,DSL_N) for carrying high frequency analog signals (HF_1,...,HF_N) to and from subscriber stations (12_1,...,12_N), said apparatus comprising a local part and a remote part and means (33, 34, 58, 59) for communicating signals between the local part and remote part via a high speed link, the local part adapted for location at a central office (13) and comprising a data network interface unit (31) for exchanging digital data signals with said data network via a data switch (27), said remote part being adapted for location at a position intermediate the central office and said subscriber stations and comprising an analog interface unit (29), the apparatus further comprising a modem unit (30) in one of said local part and remote part and between the data network interface unit (31) and said analog interface unit (29), said analog interface unit (29) for converting said high frequency analog signals into modulated digital signals and vice versa, and said modem unit for demodulating said modulated digital signals to form digital data signals for supply to said data network interface unit and for modulating said digital data signals to form said modulated digital signals for supply to said analog interface unit.

2. Access apparatus according to claim 1, wherein the modem unit (30) is in the local part and coupled to the analog interface unit (29) by way of said interface means (33, 34) and said high speed link.

3. Access apparatus according to claim 2, wherein said high speed link includes an optical fiber cable (35C) and said interface means (33, 34) comprises local (34) and remote (33) optical interface units at the local part and remote part, respectively.

4. Access apparatus according to claim 1, wherein said data network interface unit is in a digital subscriber line access multiplexer (DSLAM) (25) that processes said digital data signals to form high frequency analog signals, and vice versa, and said local part further comprises an additional analog interface unit (29A) for converting high frequency analog signals received from said DSLAM (25) to modulated digital signals and supplying said modulated digital signals to said interface means (34), or converting modulated digital signals received via said interface means (34) from the analog interface unit (29) at the intermediate position into high frequency analog signals and supplying said high frequency analog signals to said DSLAM (25)

5. Access apparatus according to claim 1, wherein said modem unit (30) is in said remote part and said interface means (33, 34; 58, 59) comprises a local interface unit (34) and first multiplexer/demultiplexer unit (58, 59) at said local part and a remote interface unit (33) and a second multiplexer/demultiplexer units (63, 64) at said remote part, the first and second multiplexer/demultiplexer units being operable to multiplex said digital data signals for transmission via said local and remote interface units and said high speed links and the demultiplexers being operable to demultiplex received multiplexed digital data signals.

6. Access apparatus according to claim 4, wherein said modem unit (30) also is in said remote part, and said first part further comprises an additional modem unit (30A), said additional analog interface unit (29A) supplying said modulated digital signals to said additional modem unit (30A) which demodulates said modulated digital signals and supplies the resulting digital data signals via said interface means (33, 34) to the modem unit (30) in said remote part, said additional modem unit (30A) modulating digital data signals received from said modem unit (30) and supplying the resulting modulated digital signals to said additional analog interface unit (29A).

7. Access apparatus according to claim 1, wherein said modem unit (30) also is in said remote part and exchanges said digital data signals with said data network interface unit (31) via said interface means (33, 34).

8. Access apparatus according to claim 1, wherein said local part comprises a plurality of said interface units (82_2,..., 82_M) for receiving digital data signals from said remote part, each of said interface units (82_2,...,82_M) processing said digital data signals to form a different kind of signal for output via a respective one of a set of additional interface units (84-87).

9. Access apparatus according to claim 8, wherein said central office (13) further comprises a digital subscriber line access multiplexer (DSLAM) and said additional interface units comprise a DSLAM interface unit (84) comprising a modem unit and an analog interface unit for converting digital data signals received from the second part into high frequency analog signals and supplying same to said DSLAM (25).

10. Access apparatus according to claim 8, wherein said interface units (82_2,..., 82_M) are greater in number than said additional interface units (84-87) and the apparatus further comprises switching means (83) for coupling selected ones of the first mentioned interface units (82_2,..., 82_M) to said additional interface units (84-87).

11. Access apparatus according to claim 1, wherein said interface means comprises one or more optical interface units (33_2, 33_3, 33_4) in said remote part, said analog interface unit (29) in said remote part comprises a plurality of said analog interface circuits (61_2,..., 61_N) each coupled to a respective one of a plurality of subscriber stations and greater in number than said optical interface units (32_2, 33_3, 34_4) and said remote part further comprises a selection switch unit (90) for coupling said analog interface circuits selectively to said optical interface circuits.

12. Access apparatus according to claim 8, wherein said local part comprises a first access unit (80/1) and a second access unit (80/2) the apparatus further comprises at least one second remote part (32/2), the first mentioned remote part (32/1) being connected to the access units by first and second high speed communications links respectively, and the second remote part (32/2) being connected to the first and second access link by two additional high speed communication links, respectively.

13. Access apparatus according to claim 7, wherein each modem unit (30) comprises a plurality of modems ($30^1{}_2$,..., $30^{32}{}_2$;...;$30^1{}_5$,..., $30^{32}{}_5$) each for modulating user-specific digital data signals received from said data network interface unit to form corresponding user-specific modulated digital signals and demodulating user-specific modulated digital signals received from said analog interface unit to form said user-specific digital data signals.

14. Access apparatus according to claim 1, wherein said intermediate position is at a junction where a feeder cable (21) from the central office (13) is coupled to several distribution cables (19A, $19B_{21}$), each of which is connected to several subscriber loop sections (17_N), each connected to a respective one of said subscriber stations (10_1,..., 10_N).

15. Apparatus according to claim 1, wherein a POTS splitter/combiner is provided to receive the high frequency analog signals from the analog interface unit (29) and POTS signals from a POTS switch and convey either or both to the subscribers, or vice versa.

16. Apparatus according to claim 1, wherein the modem unit (30) comprises a set of one or more digital signal processor (DSP) modem units (30_1, ..., 30_M) for processing the digital data signals and routing the processed signals to the data network and for processing signals from the data network and supplying the resulting digital signals to respective ones of the interface units, and switching means (92) for connecting the DSP modem units selectively to the subscriber lines for at least the duration of a call.

17. Access apparatus according to claim 16, wherein the DSP modem units use different line codes for different ones of the plurality of digital signals.

18. Apparatus according to claim 16, wherein the switching means (92) comprises a circuit switch unit for making virtual connections between respective ones of the analog interface unit (29, ..., 29_N) whose associated subscriber lines are active and said one or more DSP modem units, the circuit switch unit maintaining each said connection for the duration of a session or call.

19. Apparatus according to claim 16, further comprising an activity processor (93) for detecting whether or not said subscriber lines are active, the circuit switch unit (92) selecting a particular line in response to a signal from the activity processor indicating that the line is active.

20. Access apparatus for connecting a plurality of DSL lines to a data network (28), comprising

(i) a plurality of analog interface units (29, ... 29_N) connected to a plurality of DSL lines, respectively, for converting DSL signals to modulated digital signals, or vice versa.

(ii) a set of one or more digital signal processor (DSP) modem units (30_1, ..., 30_M) for processing the modulated digital signals and routing resulting digital data signals to the data network and for processing digital data signals from the data network and supplying the resulting modulated digital signals to respective ones of the analog interface units, and

(iii) circuit switching means (92) for connecting the DSP modem units selectively to the DSL lines for at least the duration of a call.

21. Apparatus according to claim 20, wherein the switching means (92) comprises a circuit switch unit for making virtual connections between respective ones of the interface units whose associated subsciber lines are active and said one or more DSP modem units, the circuit switch unit maintaining each said connection for the duration of a session.

22. Apparatus according to claim 20, further comprising an activity processor (93) for detecting whether or not said subscriber lines are active, the circuit switching means (92) selecting a particular line in response to a signal from the activity processor indicating that the line is active.

23. Access apparatus according to claim 20, wherein a plurality of said DSP modem units (30_1, ..., 30_M) are connected to the switch unit (92) and the switch unit is operable to select any one of the DSP modem units for connection to a particular active DSL.

24. Access apparatus according to claim 20, wherein each analog interface unit is arranged to exchange signalling with a user station connected thereto by the associated subscriber line so as to set up a session and maintain the connection therebetween, and the apparatus further comprises an activity processor (93) associated with the switching means for detecting said signalling as user activity indicative of an attempt to establish a session and connecting the corresponding subscriber line to said one of the DSPs.

25. Access apparatus according to claim 24, wherein the activity processor (93) is arranged to permit, in normal circumstances, the duration of the session to be determined by a user station connected to the line.

26. Access apparatus according to claim 25, wherein the activity processor (93) is arranged to permit the user to set a predetermined session duration when initiating the session.

27. Access apparatus according to claim 24, wherein the activity processor (93) is arranged to determine session duration by terminating the session when there has been no activity for a predetermined interval.

28. Access apparatus according to claim 25, wherein the activity processor is arranged to terminate the session in response to a termination request from the user station.

29. Access apparatus according to claim 20 wherein said one or more DSP units are each arranged to process signals from several of the DSL lines simultaneously.

30. Access apparatus according to claim 29, wherein said one or more DSP modem units use different line codes for different ones of said signals.

31. Access apparatus according to claim 20, further comprising memory means (94) for storing a selection of different line codes for use by said one or more digital signal processors modem units, the or each digital signal processor modem unit using a particular one of the line codes in dependence upon the particular digital signal to be processed thereby.

32. Access apparatus according to claim 31, further comprising means for loading said line codes into said memory.

33. Access apparatus according to claim 31, wherein said particular one of the line codes is selected in dependence upon information supplied by a corresponding interface unit when the session is being initiated.

34. Access apparatus according to claim 20, comprising a plurality of groups of said analog interface circuits, the analog interface circuits in a particular group being connected to at least one said DSP unit by means of a high bandwidth communications channel (35/1, ..., 35/L).

35. Access apparatus according to claim 34, wherein the high bandwidth communications channel uses optical transmission.

36. Access apparatus according to claim 34, wherein the groups of interface circuits are each at a different physical location within the same central office (13).

37. Access apparatus according to claim 34, wherein at least one of the groups of interface circuits is at a physical location remote from the central office.

38 Access apparatus according to claim 34, wherein the groups of interface circuits are each located at a different central office.

39. Access apparatus according to claims 34, wherein each group of analog (interface circuit group comprises means for extracting the digital signals of active DSL lines and is associated with an optical fiber interface (33/1,..., 33L) for effecting parallel to serial conversion of said digital signals and routing the serial digital signals via the high bandwidth link communications channel.